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*Influence of Social Trends
on Agricultural Natural Resources*

PROPERTY RIGHTS, CONSERVATION, AND ECOSYSTEM-BASED ASSISTANCE

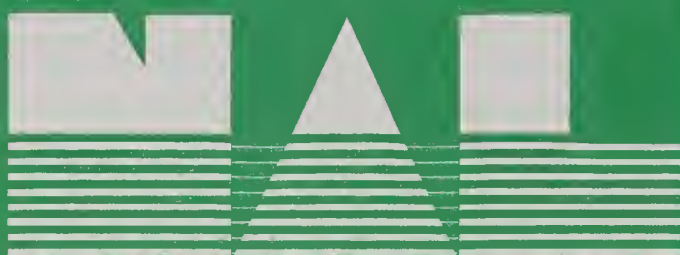
Working Paper No. 19D

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*Influence of Social Trends
on Agricultural Natural Resources*

PROPERTY RIGHTS, CONSERVATION, AND ECOSYSTEM-BASED ASSISTANCE

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This is part of a set of papers originally presented at the Symposium on
INFLUENCE OF SOCIAL TRENDS ON AGRICULTURAL NATURAL RESOURCES
cosponsored by RCA and the Social Sciences Institute (NRCS)
(May 31–June 2, 1995, Washington, D.C.)
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OVERVIEW OF THE SYMPOSIUM

The symposium on *Influence of Social Trends on Agricultural Natural Resources* took place on May 31–June 2, 1995. The speakers presented current trends and were challenged to forecast trends in conservation of our natural resources at two separate points in time—10 and 50 years in the future. This type of forecasting was an unusual challenge to the participants. Many of the “empirically oriented” social scientists chose to remain close to their data, while others did as they were asked and tried to act as seers. Only time will tell how close they came to predicting future scenarios. Assembling any group of scholars will lead to mixed forecasts. Rather than repeat each author’s message, we have tried to emphasize some common themes in the presentations. If you want to find out what the authors themselves think, read the papers. It is well worth the effort.

Although the attitudes of the public and the agricultural community differ on some issues, support for a clean agricultural environment is almost universal. The public is concerned for the safety of food and water supplies. The public also feels that laws on threatened and endangered species and wetlands are just right or have not gone far enough in providing protection. Most farmers and ranchers, along with the public, support a federal role in agricultural conservation, especially in incentive payments to promote conservation.

Most of the public would like to see federal spending on agricultural conservation increase or remain the same. The desire of the public and agricultural communities to have an incentive-based system has been partly realized with the passage of the 1985, 1990, and 1996 Farm Bills (respectively Food Security Act of 1985; Food, Agriculture, Conservation, and Trade Act of 1990; and Federal Agriculture Improvement and Reform Act of 1996). Concurrently, the public supports regulation, fines, and withholding government benefits when voluntary conservation is not working. A majority view among presenters was that with time there would be an expanded regulatory role for all levels of government vis-à-vis production agriculture. There was some disagreement on whether this expanded regulatory role would come through the use of centralized, command-and-control regulations or through the use of market-based incentives.

When given an opportunity to voice their opinions regarding conservation compliance, most farmers with highly erodible land supported the program and did not want Congress to abolish it when crafting the 1996 Farm Bill. Furthermore, farmers with highly erodible land and conservation compliance plans believed that NRCS was more than fair in its implementation of conservation compliance planning. Over the last 5 years (the period during which farmers had to acquire their plans and have them fully implemented), farmers have been consistent in their support of the program. However, there is a troubling drop in the percentage of farmers with conservation compliance plans who believe that monitoring and enforcement are being carried out in such a way that farmers who are out of compliance will be found out and will lose eligibility for USDA program benefits.

The environment and ecosystem management will remain important future issues for the public and agricultural producers. During the next 50 years, as the global population continues to grow, agricultural producers and agribusinesses will be challenged to expand food production and the processing and distribution systems to keep pace with population growth without endangering the ecosystems supporting production agriculture. In industrialized countries, alternative food sources will be developed, environmental monitoring will become more widespread and more precise, and new environmentally benign methods of production agriculture and food processing will be developed. Given capital limitations, resource constraints, and increasing demand for food, the poorer countries will face growing environmental challenges as they use their physical resources more intensively in the effort to feed their populations and expand their trade abroad. Sources of environmental stress will be in the energy, manufacturing, and extractive industries in addition to agriculture. The future of humanity will depend on the development and sharing of appropriate technologies and mobilizing global efforts to effectively control population, produce enough food and fiber, and protect the environment.

A number of papers underscored the structural transformation underway in the agricultural and financial sectors. Increased vertical integration and the separation of land and resource ownership for farm operations are rapidly changing the character of agriculture. For example, one author suggested that in the 1980s banking and finance became more national, if not global, as local banks and credit unions—especially in rural areas—went out of business. The cold dollars-and-cents business world of finance merges uncomfortably with the inherent instability of agriculture and the accompanying fluctuations of farm income. During the next 10 years, income in the agricultural sector may be even more volatile, due to the elimination of the farm income safety net. With the gradual removal of this safety net through the 1996 Farm Bill, farmers will face increased financial risk and greater uncertainty. A challenge for operators will be the development of strategies for shifting the increased risk from themselves to others.

One consequence of the consolidation within the financial sector will be the shifting of funds away from rural areas and the increased reliance of farmers on capital and operating loans coming more from commodity processors and input suppliers than from traditional banking sources. Corporations will begin to own more agricultural land, and for the land they do not own, they will contract with farmers as to what to produce and how to produce it in exchange for a guaranteed market for the commodity. In many instances, the farmers will be no more than salaried workers. One impact of these changes will be to make farmers dependent on agribusinesses. Farmers and farm managers will have a vested interest in production, not conservation. In this transformed world of agriculture, a major challenge will be the public sector's voice demanding food safety, environmental quality, and worker health and safety.

Much of the livestock industry—cattle, chickens, hogs, turkeys, and sheep—is currently controlled by a few companies. In addition to livestock conglomerates, industrial consolida-

tions of port facilities and feed, elevator, milling, and soybean-crushing plants limit market access for individual producers. Companies that contract for agricultural products are not typically held responsible for environmental impacts, while individual producers are. Hence, while agricultural processors will increasingly specify what to produce and how to produce it, the environmental consequences of those specifications will shift to individual producers. However, the public will exert enough pressure so that environmental responsibilities will likely be pinpointed as this type of agricultural concentration increases. Not only will concentration of production and processing take place in the livestock sector, it will also occur with grain and oilseed crops, their processing, and the transportation of all agricultural commodities. Farmers, public interest groups, and government officials are just now becoming aware of the structural changes sweeping over agriculture and of the implications they hold for producers, consumers, and the environment.

Crop biotechnology is not currently and will not in the next 10 years be a significant factor in relation to environmental quality. However, some aspects of agricultural industry are more directly affected by biotechnology than others. For example, the livestock industry has been affected through the development of growth hormones and vaccines for increasing livestock production. In contrast, it is more difficult to manipulate cereal grains through bioengineering technology than was thought at first. In fact, these common grains may be easier to modify through conventional breeding techniques that improve multiple genetic (polygenic) traits than by the use of biotechnology, which focuses more easily on single genetic traits.

Crop biotechnology (e.g., herbicide- and pesticide-resistant crop varieties) is following an established technological trajectory rather than defining a new path. Some of these developments feed into existing monocultural practices (with their attendant environmental problems) and limit the use of crop rotations. Mechanization and industrialization are the current dominant trends in agriculture, and biotechnology complements these trends. Biotechnology will have mixed effects on environmental quality, and its impact depends to a great degree on how public policy is implemented in the environmental arena.

Several researchers projected that national conservation institutions over the next decade will remain in place but with reduced funding. State and local institutions will need to significantly increase resources directed toward conservation. Stronger agricultural regulations will be passed at the state and local levels. However, in general, states and local areas do not have the financial capabilities to provide full-service technical assistance and cost-sharing for conservation, nor do they have the staff capabilities to regulate the agricultural industry. In fact, one of the challenges is not only the extent to which states can pass legislation on soil and water conservation but the extent to which they can implement and administer the laws they have. Presenters recommend that state and local political institutions acquire taxing authorities so they can more directly provide staff assistance and incentives to foster natural resource protection and enhancement at the local level. While state and local units of government could assume greater responsibility for soil and water conservation programs,

an important challenge will be how much *both* the agricultural and nonagricultural communities are involved in decisionmaking, as well as how closely local concerns reflect the environmental concerns of the wider community.

The projected unit of analysis for agricultural conservation work is at the watershed level. While this unit may be very appropriate for ecosystem planning (e.g., ecological linkages across a landscape, a context for socioeconomic-political institutions), it presents a number of challenges that have to be addressed if the watershed approach is going to achieve its promise. For example, what is the spatial scale at which a watershed is defined? Is a large-scale or small-scale approach taken to delineate watersheds for planning purposes? Another question is, what criteria are used to separate watersheds: are they biological, social, or topographic in nature? How can watershed planning be reconciled with various overlapping levels of government that have to be coordinated and through which administrative control of conservation policy is exercised? And finally, how can procedural and substantive issues of the wide variety of organizational missions be addressed at a watershed level?

The idea came up repeatedly that while most farmers and ranchers use sound conservation systems, 10 to 15 percent of them are “bad actors.” These producers are unaware of or choose to ignore the negative effects of their production systems on the environment. It will be extremely difficult to change the behavior of these people. Participants felt that the larger society will eventually demand that the bad actors be penalized for polluting the environment. The penalties might come as fines, stricter environmental regulation and enforcement, or more programs like conservation compliance. Two forces are at work. First, the structural changes taking place in agriculture are working to destroy the Jeffersonian image of the yeoman farmer that gives farming special status vis-à-vis environmental regulation. Second, more and clearer information about the interaction of production agriculture and environmental quality will result in stronger public demand for environmental protection. Improved resource inventories will facilitate the tracking of environmental degradation and the levying of penalties. Resource inventories will become more important in the future, based on two trends: *increased accountability* for scarce financial resources, and *advancing scientific capabilities* that increase the ability of conservation partners to assess and monitor environmental conditions.

Environmental justice was another topic discussed. Industry and agriculture have taken advantage of minorities by ignoring the effect of agricultural pollutants on minority populations and by placing chemical production, waste facilities, or concentrated farm operations in minority communities. A Presidential Executive Order on Environmental Justice (Executive Order 12898) attempts to address this issue. During the next 10 years, increased awareness of these issues in minority communities will merge with more reliable and accessible information to slow but not stop these negative impacts. The “not in my backyard” movement, a classic middle-class movement, helps to relocate agricultural pollution to minority areas. It will take many years before this entrenched trend is offset.

The future moves erratically, with many choices that each yield unclear results. History has the advantage of being able to look back to add meaning to society's many bends in the road. The exercise of looking ahead 10 and 50 years forces researchers to rely on their basic assumptions about the nature of human beings as well as the influence that systems wield on future events. Skepticism and optimism were the yin and the yang of this symposium. Comparing the present to a future ideal is frustrating because, in some cases, the present environment is toxic to living creatures. However, at the same time, there is room for optimism. The continuing environmental movement in general has been strengthened and sculpted by the legislative and executive branches of different levels of government. This can be attributed to the public's strong support for wetlands, wise use of agrichemicals, food safety, water quality, threatened and endangered species, and safe recreational opportunities. The public also supports localized decisionmaking, which puts human and physical resources in local hands.

As we look 50 years into the future, the trend toward the industrialization of the agricultural sector is bound to accelerate. It seems conservationists are presently pushing their bandwagon down a slight grade because of the public's support. To speed up the wagon, we must institutionalize two new inputs besides the traditional inputs of land, labor, technology, and capital. These added inputs are *environmental considerations* and *fairness/equity*. As these inputs become standard costs for doing business, the agricultural sector will realize its potential to be healthy, fair, and productive.

Frank Clearfield and Steven Kraft

June 1997

PRIVATE PROPERTY RIGHTS AND NATURAL RESOURCE CONSERVATION

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Introduction

The debate over private property rights, “takings,” and natural resource conservation has captured increasing public attention over the past several years. Private property reform was one element of the House Republicans’ “Contract With America” last fall, and legislation requiring compensation for certain types of land-use regulation was passed by the House on March 3, 1995. Even more comprehensive legislation is currently being considered by the Senate.

These bills challenge the way that resource conservation policy is carried out in a wide variety of contexts, and will undoubtedly influence debate over reauthorization of the Farm Bill, the Clean Water Act, and the Endangered Species Act. This paper reviews the history of the property rights issue, the legislative proposals currently being considered by Congress, and their implications for natural resource conservation.

Background

Takings and the Constitution

The Fifth Amendment to the Constitution, ratified in 1791, states that private property shall not be taken for public use without just compensation. Prior to the twentieth century, the legal interpretation of a “taking” was limited to instances of physical occupation or acquisition of land by the government. By contrast, restrictions on land use were not viewed as takings.

During much of American history, land was abundant, neighbors were few, and formal land-use restrictions were largely unnecessary. By the early twentieth century, however, faced with a growing population and the closing of the Western frontier, municipalities and state legislatures nationwide began recognizing the need to codify long-standing common law “nuisance” principles in the form of zoning and other land-use regulations designed to protect neighboring properties and the public interest in general. Along with these regulations came challenges from landowners, leading eventually to a landmark decision by the Supreme Court.

Regulatory Takings and the Supreme Court

In a 1922 decision that struck down a Pennsylvania law restricting coal-mining operations, the Supreme Court held that “while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking” (*Pennsylvania Coal v. Mahon*)—even if there is no physical occupation of the property. This introduced an economic criterion—diminution of property value—among the legal factors traditionally considered in the determination of a taking. Nevertheless, state and federal courts have generally rejected regulatory takings claims if (1) the owner is left with any reasonable economic use of a property, (2) the regulation serves a valid public purpose, and (3) the regulation is reasonably related to the declared public purpose.

Addressing the question of what is “reasonable” with respect to these criteria, recent Supreme Court decisions have used language like “essential nexus” (*Nollan*, 1987) and “rough proportionality” (*Dolan*, 1994), but they have not established a clear test of how much diminution in value is required before a taking occurs. While these cases have been viewed by some as victories for the property rights movement, the Court did not challenge the basic authority of the government to regulate land use in the public interest. Even in the widely-publicized *Lucas* decision in 1992, the Court noted that government regulations cannot take claimed “rights” that never existed due to background principles of property and nuisance law (Sugameli, 1994). And as recently as 1993, the Court reaffirmed that diminution of value alone does not result in a taking (Duerksen and Roddewig, 1994).

President Reagan’s Executive Order

In March 1988, President Reagan issued Executive Order 12630, which directed government decision-makers to “evaluate carefully the effect of their administrative, regulatory, and legislative actions on constitutionally protected property rights.” No formal assessment or certification process was required, however, and findings were not subject to judicial review. Consequently the Order’s impact has been difficult to determine. Advocates of property rights reform would like to see a more formal takings assessment process established along with statutory compensation requirements.

The Property Rights Movement

Impatient with the judicial system’s case-by-case approach to the takings issue, and frustrated with the limitations of Reagan’s Executive Order, advocates of property rights reform have become increasingly organized and vocal over the past decade. The property rights movement today consists of some 500 groups nationwide seeking to reduce federal restrictions on the use of private land. (The movement is related to the “wise use movement,” which advocates reduced federal controls over the use of public lands. Also related is the “county movement,” which denies the very legitimacy of federal land ownership in the western United States.) Reform advocates are supported by corporate interests such as the mining, petroleum, timber, farming, and ranching industries (Jacobs, 1995). Over the past

several years, takings legislation has been considered in 44 states, and bills of varying strength have been passed in 13 states (Lund, 1995).¹ With the 104th Congress, property rights reform is now receiving unprecedented attention at the national level as well.

Property Rights in the 104th Congress

At least ten bills relating directly to private property rights and takings were introduced in the first 100 days of the 104th Congress—along with numerous other bills that address private property rights in the context of wetlands and endangered species habitat. (By contrast, some 22 such bills were introduced in the entire 103rd Congress, 12 in the 102nd, and just one in the 101st.) Property rights bills generally feature at least one of two basic requirements: “takings impact assessments” before federal agency actions that may result in takings, and compensation for landowners if federal agency actions reduce property values by more than a specified amount or degree.

On March 3, the House passed H.R. 925, the Private Property Protection Act of 1995. H.R. 925 would establish a landowner’s right to compensation from the federal government whenever the value of a portion of a property is diminished by 20 percent or more as a result of use restrictions imposed under various provisions of federal environmental, agricultural, or water law. A landowner would have the option of requiring the federal government to buy the restricted portion of his property (at its unrestricted value) if it lost 50 percent or more of its value as a result of agency actions.

While H.R. 925 never actually mentions the word “taking,” it would effectively complete a transformation in the definition of the concept that began with the Supreme Court in 1922: from a historic understanding in terms of physical acquisition, to an intervening period in which economic factors such as diminution in value were considered alongside legal criteria, ending with a statutory redefinition on the basis of diminution in value alone.

As a result, H.R. 925 would require compensation whenever the threshold diminution in value is met or exceeded—whether a legally defined right is actually taken from the landowner or not. This is a critical departure from prior takings law, since it means that compensation requirements would cover not only regulatory programs but voluntary programs as well. In fact, alongside regulatory programs under the Endangered Species Act and Section 404 of the Clean Water Act, H.R. 925 specifically targets the conservation provisions of the 1985 Farm Bill. Senator Dole’s bill (S. 605, the Omnibus Private Property Protection Act of 1995) is even more comprehensive, covering all actions by federal agencies as well as actions by state agencies carrying out regulatory programs under federal law.

¹ In one of these states, Arizona, voters subsequently defeated takings legislation by a 2 to 1 margin in a November 1994 referendum.

Implications for Natural Resource Conservation

Whether through stand-alone bills or through takings and compensation provisions within other legislation, advocates of property rights reform will set the tone this year for reauthorization of major laws affecting the use and conservation of soil, water, habitat, and other natural resources.

The Farm Bill

It remains unclear how property rights considerations will affect farm programs, but the possibilities are evident in the language of H.R. 925. Specifically, H.R. 925 would require compensation for enforcement of the swampbuster and conservation compliance provisions of the 1985 Farm Bill—conditions placed on farmer participation in voluntary programs administered by USDA—even though such conditions are not considered takings (and thus require no compensation) under current law.

Compensation would be determined as the loss in value of the portion of a farm on which use had been restricted. (Perhaps ironically, H.R. 925 overlooks the fact that violators of swampbuster or conservation compliance conditions may lose program benefits not only on the portion of a property on which use has been restricted, but on their entire properties.) That loss would in turn be calculated as the difference between (a) the value of that portion if it were cultivated and receiving program benefits, and (b) the value of that portion if it were cultivated without receiving program benefits.

In general, land values are based on expectations about the stream of returns generated by use of land. Agricultural land values are thus based on expectations about input costs, yields, and prices, all of which are influenced by both market conditions and government policies. Since the 1960s, a large body of research has shown how commodity price supports and other income enhancements in turn support agricultural land values. Shoemaker et al. (1990), for example, estimate that average farmland values would be 15 to 20 percent lower in the absence of farm programs.

Estimation of the potential cost of compensation for the swampbuster and conservation compliance provisions is hampered by the fact that the withdrawal of program benefits would have widely differing impacts on farmland values in different regions and on different farms. This makes it extremely difficult to estimate how often the effect of sanctions would meet or exceed the 20-percent threshold specified in H.R. 925. If such a bill were to become law, however, an indication of the possible magnitude of compensation claims that might be made against swampbuster can be seen in the 1992 National Resources Inventory, which found about 6.3 million acres of farmed wetlands, wetlands on cropland, and wetlands on non-cropland considered highly likely to be converted. Perhaps half of these wetland acres lie on farms that participate in federal programs, and are thus subject to sanctions.

A longer-term consideration involves the eventual impact of budget cuts on farm programs. In the extreme case, such cuts could themselves be regarded as requiring compensation. While it seems improbable that legislation will ultimately go that far, a much more likely outcome is that program participation will decline and the contribution of program benefits to farmland values will diminish even on participating farms. As the leverage provided by program benefits declines, so too will the potential for compensation claims against swamp-buster and conservation compliance.

Budget cuts also limit the potential for extension of the Conservation Reserve Program or expansion of the Wetlands Reserve Program—programs which face no objections from advocates of property rights reform on the basis of either legal or diminution-of-value criteria.

The Clean Water Act

The impact of the Clean Water Act on agricultural land use has thus far been limited by the fact that 53 million acres of wetlands converted to cropland prior to 1985 are exempted from Section 404's jurisdiction. Furthermore, a nationwide general permit exempts farmers' actions that are determined by USDA's Natural Resources Conservation Service to have minimal effect on wetlands. Thus, although Section 404 wetlands regulations have concerned farmers, exemption clauses reduce their implications for agriculture and thereby lessen the relevance of legislation that would require compensation. The Environmental Working Group (1995) cites Corps of Engineers data that just 3,448 (6.7 percent) of 51,215 individual permit applications in 1992 pertained to farmland; of the 3,448, only 27 (0.8 percent) were denied. Federal courts have found takings under Section 404 in only three cases (American Planning Association, 1995).

Even though relatively few permits have been denied, activities blocked, or takings determined by the courts under Section 404, planned land uses may have been scaled back in other cases, preventing realization of higher expected future earnings and reducing current property values as a result. Perhaps as a result of such concerns, the permitting program under Section 404 is one of the federal actions specifically targeted by H.R. 925. On May 16, the House of Representatives passed H.R. 961, which would revise the Clean Water Act itself. H.R. 961's Title VIII, the Comprehensive Wetlands Conservation and Management Act of 1995, would classify wetlands into types A, B, and C, depending on their ecological significance—notwithstanding scientific concerns about the validity of such classification (National Research Council, 1995). Type A wetlands would receive the greatest protection, type B wetlands would receive less protection, and no permit would be required for activities on type C wetlands. The bill includes much of the text of H.R. 925, and would thus require compensation whenever federal agency actions diminish the value of any type of wetland by 20 percent or more.

The Endangered Species Act

Nationally, about 45 percent of threatened and endangered species are associated with agriculture, primarily due to pesticide use and wetlands conversion. Nevertheless the impact of the Endangered Species Act on agriculture has been minimal to date, in part because the federal government's ability to restrict the use of private land (as opposed to directly harming a listed species) is limited. The Environmental Working Group (1995) cites World Wildlife Fund data that 352 (0.4%) of 96,830 assessments of potential violations between 1986 and 1992 were found to jeopardize a listed species; only 54 activities were blocked as a result. And the American Planning Association (1995) notes that "[i]n the only two reported takings cases under ESA in federal courts . . . the courts ruled that no taking occurred."

As was the case under the Clean Water Act, however, planned land uses may be curtailed as a result of the Endangered Species Act even when permits are not denied or activities blocked. Like the Clean Water Act, the Endangered Species Act is both a specific target of H.R. 925 and the subject of numerous other property rights-related bills currently being considered on Capitol Hill. Several bills have been introduced to freeze activity pending reauthorization of the Endangered Species Act, and on April 10 President Clinton signed into law a supplemental appropriations bill that included a rider imposing a six-month moratorium on new species listings and critical habitat designations as well as a corresponding \$1.5 million rescission in the Fish and Wildlife Service's budget.

On May 9, Senator Gorton (R-WA) introduced a bill, S. 768, to reauthorize the Endangered Species Act. While the bill does not require compensation of landowners, it would weaken species protection by requiring the Interior Department to consider "the broadest array of human, social, economic and biological factors" in listing species and designating critical habitat (*Land Letter*, 1 May 1995). (In so doing it would swing the pendulum of assessment criteria farther away from the strict focus on biological factors required by the 1982 reauthorization, itself a shift from the consideration of both biological and economic factors in the 1978 reauthorization.)

Subsequent versions of this year's reauthorization legislation are expected to contain compensation requirements. They are also expected to limit the federal government's ability to restrict the use of private land by excluding habitat destruction from the list of activities that constitute "harm" in Fish and Wildlife Service regulations implementing the Endangered Species Act—regardless of the Supreme Court's decision in the *Sweet Home* case.

Conclusion

Congress is currently considering legislation that would sharply reduce the federal government's ability to influence the use of public and private lands in ways that balance private property rights with public interests in natural resource conservation. Proposals include a

historic change in the definition of the notion of takings—from an understanding based on physical occupation of land, followed by the introduction of diminution in value as one among several factors that have been considered by the courts since 1922, to the language of H.R. 925 and S. 605 requiring compensation based on diminution in value alone.

Whether or not stand-alone takings legislation is passed by Congress, calls for takings impact assessment and compensation requirements are likely to feature prominently in the debate later this year over reauthorization of the Farm Bill, the Clean Water Act, and the Endangered Species Act. Budget constraints will limit support for compensation requirements, but they will also limit the federal government's ability to protect wetlands, wildlife habitat, and other natural resources through programs like the Conservation Reserve Program and the Wetlands Reserve Program.

Despite the threats to resource conservation posed by property rights legislation and budget constraints, the outlook is not entirely bleak. Over the next decade, cuts in farm programs will reduce incentives to produce agricultural commodities on wetlands, highly erodible soils, and land with other valuable natural characteristics—diminishing some of the land use conflicts that generated claims of regulatory takings in the first place. Over the longer run, and in a broader sense, it remains to be seen whether American landowners and taxpayers will move beyond their history of land abundance and westward expansion towards a greater recognition of the public interests, including natural resource conservation, that accompany private property rights.

ECOSYSTEM-BASED ASSISTANCE: COWBOYS AND SPACESHIPS

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Introduction

This paper will define Ecosystem-Based Assistance (EBA) in the Natural Resources Conservation Service (NRCS) and project the effect EBA will have on natural resource trends as well as on the Resources Conservation Act (RCA) analysis. The crux of the problem lies in how we view the world. What is needed goes beyond Kenneth Boulding's 1966 article, "The Economics of the Coming Spaceship Earth," wherein he argued that we must choose between a "cowboy" perspective of the economy that views resources as unlimited and a "spaceship" perspective that explicitly recognizes that natural resources are limited. What is needed is an ecological perspective that recognizes, over time and across space, that agroecosystems are a set of complexly interconnected components governed by basic ecological, economic, and social processes.

Definition

In 1935, Arthur Tansley coined the term *ecosystem* and defined it as a way to analyze nature that considers biotic and abiotic components as a whole. The key concept "is the idea of progress towards equilibrium, which is never, perhaps, completely attained, but to which approximation is made whenever the factors at work are constant and stable for a long enough period of time."

However, it was not until after Tansley's death in 1955 that the term ecosystem began to be used in the scientific literature. Even today, ecology is widely misunderstood, with people often using it interchangeably with environment as in ". . . this is good for the ecology." Strictly speaking, nothing is good or bad for ecology. It is the way the world works.

The term "ecosystem management" gained broad usage during the spotted owl debate. The first commission charged with developing a plan to resolve issues stemming from the logging vs. preservation conflict in the Northwest ran into insurmountable technical difficulties, in part because it was trying to manage a single species. The second commission was more successful because it framed the question in terms of ecosystems.

During the time the spotted owl debate was occupying the Forest Service, SCS had moved toward holistic planning. One of the five strategic initiatives identified in the agency's 1992 strategic plan was "total resource management." As the initiative was being implemented, the need to change its name became apparent. The principles of ecology enabled a much clearer, more scientific definition of what the agency wanted to achieve. However, the term ecosystem management conveyed the erroneous notion that the agency had true land management responsibilities. In order to reflect the fact that SCS assists private land owners in making land management decisions, the term *Ecosystem-Based Assistance* was adopted.

Ecosystem-Based Assistance is defined by the Natural Resources Conservation Service as the appropriate integration of ecological, economic, and social factors through the NRCS planning and assistance process to maintain and enhance the quality of the environment to best meet society's current and future needs.

That ecosystem-based assistance is comprised of three components (Ecology, Economics, and Sociology) is essential for understanding how NRCS will incorporate EBA into all levels of its planning, including RCA.

In addition, it should be noted that NRCS works with landowners and operators to help them manage agroecosystems. Odum defines agroecosystems as *domesticated* ecosystems that have—

dependence on *auxiliary energy inputs*;
reduced natural diversity because humans maximize selected yields;
artificially selected dominant plants and animals;
goal-oriented controls rather than internal feedback.

Agroecosystems, like all ecosystems and economic units, can be modeled as input-output systems. Energy is constantly flowing into an ecosystem, but in natural ecosystems there is an energy balance that allows the systems to be self-sustaining over long periods. Agroecosystems on the other hand require significant inputs of auxiliary energy. This lack of "natural balance" limits the sustainability of agroecosystems. Any movement toward reduced inputs or reduced outputs enhances the sustainability of the agroecosystem.

Finally, during the past couple of years opponents of ecosystem management have used private property rights as means to halt the implementation of ecologically based management plans on federal lands. Technically, a *taking* would require—

unfair treatment by the government (Lucas);
 a clear connection between a proposed land-use and the government regulation or exaction imposed on the landowner in return for land-use approval (Nollan);
 and finally, rough proportionality between the private costs of exactions and the external costs of the development (Tigard).

Much of the concern about private property rights can be mitigated if EBA is carefully applied with emphasis on developing a locally based, widely shared vision that fully considers the objectives of all stakeholders.

Goal: Ecosystem Health

Implementation of ecosystem management or ecosystem-based assistance requires a vision of how the stakeholders would like to see the landscape. In the literature, this vision or goal is often referred to as *ecosystem health*. Defining ecosystem health is problematic. First, the ecosystem health goals must be consistent with the functions of the ecosystem. That is, it would be inconsistent to apply the ecosystem health standards of a pristine or undisturbed ecosystem to an agroecosystem. Second, ecosystem health must be defined in terms of ecological, economic, and social goals. Third, the term “health” may convey a sense of absolute healthiness. For example, in human health a body temperature of around 98.6 degrees Fahrenheit is considered healthy. With ecosystems, an analogous criterion of health may not exist. Fourth, implementation of ecosystem-based assistance requires a set of indicators that are easy to measure and reflective of complex resource interactions within the ecosystem.

Constanza gives the following criteria of ecosystem health:

- Absence of Disease
- Diversity or Complexity
- Stability or Resilience
- Vigor or Scope for Growth
- Balance between Components

In practical terms he states that “. . . assessing health in a complex system—from organisms to ecosystems to economic systems—requires a good measure of judgment, precaution, and humility, but also a good measure of systems analysis and modeling in order to put all the individual pieces together into a coherent picture.” Initially, indicators of ecosystem health will be direct measures of individual resources (for example, soil erosion and net income). In some cases measuring “endpoints” or important composites, species, or sectors will be possible (for example, in an agricultural region, soil quality and employment). Finally, *overall* system performance or health must be measured.

What is essential in EBA is that the ecosystem health and the associated indicators be developed at the local level, with all interested parties involved.

The Principles

Grumbine, in his book, *Ghost Bears*, condenses ecosystem management principles to: “think big and think connected.” Expanding this slightly, in terms of ecosystem-based assistance, the basic issues are

- Interconnectedness
- Long Term
- Shared Vision
- Adaptive Management

Recognition of the importance of stressing the interconnectedness is essential to shifting from a natural resources “cowboy” perspective to an ecological “spaceship” perspective. With a natural resources philosophy, society protected natural resources by drawing a line around them. Zoos, national wilderness areas, and reservations are examples of this approach. With an ecological philosophy, society will protect natural resources by understanding how things are connected. Natural systems are inherently complex and what might appear as random behavior is actually a manifestation of chaos theory. Things are not so much random as they are unpredictable. Finally, ecosystems need to be viewed as *nested*. That is, when analyzing an ecosystem, it is important to also consider the larger ecosystem and smaller ecosystems.

Valuation of the long term is essential to satisfying ecosystem health goals. From the human standpoint, this issue encompasses intergenerational equity and maintenance of future options. Society and individuals may have to begin to think in terms of natural infrastructure and our responsibilities for maintaining it.

Implementation of an ecological approach to natural resource conservation will require that we develop a shared vision of stakeholders’ goals. This will require that all those directly or indirectly affected be involved in planning, implementation, and monitoring.

Adaptive management is a renewed emphasis on monitoring the effects of a plan and making modifications to the plan or to new plans so that the desired results are more readily and efficiently achieved. Adaptive management recognizes that our knowledge about ecosystems is incomplete. Therefore, it is wise to use the best available science in planning, implement a plan, and then monitor the plan's performance and transfer this information into the knowledge base.

The following principles of ecosystem-based assistance were developed by an interdisciplinary NRCS team. The six principles provide the foundation for planning, evaluating, and implementing all NRCS programs and activities. EBA integrates ecological, economic and social factors through NRCS’ planning and assistance processes to maintain and enhance the quality of the environment to best meet the land-user’s and society's current and future needs.

I. Ecosystems are Hierarchical

Every planning area is encompassed within larger ecosystems and encompasses smaller ecosystems.

When providing ecosystem-based technical assistance, the planner will—

- consider relationships among levels of ecosystems to predict the effects of proposed actions or activities;
- recognize that both the larger ecosystem and the smaller ecosystems may represent different objectives of the people living in those areas. Those differing objectives likely will influence and guide decisions that are made about the planning unit;
- consider transcending administrative, jurisdictional, and geographic boundaries and their potential impacts on the planning process.

II. Ecosystems are Complex

The living and nonliving components of ecosystems are interconnected and interdependent.

When providing ecosystem-based technical assistance, the planner will—

- consider the beneficial and adverse effects on ecosystem interactions when doing planning.

III. Ecosystems are Dynamic

Temporal changes occur in ecosystem structure and function.

When providing ecosystem-based technical assistance, the planner will—

- consider both short- and long-term effects on the structure and function of ecosystems.

IV. Ecosystems Perform Critical Life-Support Functions

When providing ecosystem-based technical assistance, the planner will—

- consider how proposed actions will affect the ecosystem's biological, chemical, and physical processes, which sustain all life-support functions.

V. Humans are an Integral Part of Ecosystems

When providing ecosystem-based technical assistance, the planner will—

- recognize that human influence on ecosystems can be significant;
- consider the goals and objectives of both the individual and society;
- recognize that human welfare depends on healthy, productive, profitable, and sustainable ecosystems.

VI. Knowledge of Ecosystems is Incomplete

When providing ecosystem-based technical assistance, the planner will recognize that it—

- is based on the best currently available knowledge, science and technology;
- requires active expansion of the knowledge on ecosystems;
- is flexible and rapidly incorporates knowledge gained from its application (*adaptive management*);
- requires cooperative and integrated data collection, planning, and evaluation;
- requires shared resources and expertise.

The following are detailed descriptions of each Ecosystem-Based Assistance principle.

I. Ecosystems are Hierarchical

Every planning area is encompassed within larger ecosystems and encompasses smaller ecosystems.

The concept of an “ecosystem” is a human construct, which is used to describe and model the interactions between living organisms and their nonliving environment in a specified geographic area. This means that ecosystem boundaries can be drawn where appropriate for planning or other purposes, as long as inputs and outputs to the system are considered. Ecosystem boundaries may not match administrative boundaries.

Planning areas, such as farm fields, whole farms, watersheds and *eco regions*, can be considered as ecosystems. These ecosystems are embedded in larger ecosystems and in turn have smaller ecosystems embedded within them. Ecosystems are linked to each other by the functions they perform.

Effects which occur at the lowest planning unit level can be translated upward toward the larger ecosystems. In addition to the local site conditions, EBA must consider the inter-actions and interconnections between the smaller and the larger units of the ecosystem to accurately predict consequences and effects of proposed actions and activities.

EBA goals and objectives at the planning unit level should complement goals and objectives at higher-level ecosystems. The effects of management changes in the planning unit should be consistent with the goals and objectives of the larger ecosystems.

Each planning level addresses ecosystem management concerns or goals in different degrees of detail, ranging from the farm field level to an “eco region” or regional level.

An example of a planning unit hierarchy could be this:

- Farm or ranch field
- Conservation Treatment Unit (CTU = group of fields)
- Operating unit (a farm or ranch)
- *Area* ecosystem (watershed, airshed, or critical habitat)
- *Regional* ecosystem (groups of watersheds, airsheds, or habitats)

II. Ecosystems are Complex

The living and nonliving components of ecosystems are interconnected and interdependent.

Organisms are linked to each other and to their environment through complex cycles of nutrients, oxygen, energy, water, and other necessities of life. Maintaining the interconnections between the living and nonliving components of an ecosystem is vital to maintaining its structural and functional integrity.

The whole biosphere can be considered one ecosystem since all of the living and non-living components of the Earth's surface are ultimately linked together at the global scale. Because of the interdependency of ecosystem components and the interlinking of ecosystems at various scales, a single change of sufficient intensity can affect an entire ecosystem and the effects can be transferred to other ecosystems.

III. Ecosystems are Dynamic

Temporal changes occur in ecosystem structure and function.

Ecosystems are not static. The structure (e.g., species composition) and function (e.g., nutrient cycling) of ecosystems change naturally over time in response to climatic, geologic, biologic and other changes associated with the aging of the Earth. In turn, these changes effect other changes in the ecosystem.

Ecosystems have an inherent capacity to respond to changes without being drastically altered themselves. This capacity varies from ecosystem to ecosystem; some ecosystems being more resilient to changes than others. When the capacity of a given ecosystem exceeds its capability to absorb changes, a new and different ecosystem may replace it.

When one component of the ecosystem, either living or nonliving, is changed, the future conditions of the ecosystem likely will also be changed. The magnitude of any change in an ecosystem will determine how much the future of the ecosystem will be affected.

EBA must consider both long-term and short-term effects of planned actions. EBA requires periodic re-evaluations of ecological, social and economic conditions and trends to adapt management decisions to the changing ecosystem. EBA must account for these dynamic changes and be ready to respond to the changes by having and implementing an adaptive planning process.

IV. Ecosystems Perform Critical Life-Support Functions

Human life is dependent on ecosystems. Natural resources, such as food and fiber, as well as other components necessary for life are produced by ecosystems. In addition, ecosystems are the reservoir of many present and future medicinal and derivative products, as well as spiritual, aesthetic and restorative environments for the human spirit. Human interests are well served when the ecosystem's long-term sustainability is assured.

The EBA concept recognizes different types of ecosystems, including natural ecosystems and managed ecosystems (e.g., "agro-ecosystems"). All of these systems are sustained by basically similar functions related to productivity, energy flow, and nutrient cycling. All of these functions are essential for supporting life.

V. Humans are an Integral Part of Ecosystems

Human values and activities influence the structure and functions of ecosystems. Human actions are a key component because of direct and indirect impacts, both adverse and beneficial, resulting from those human activities. These activities can have profound impacts on ecosystems throughout the world.

The role of humans is strongly considered in the formulation and delivery of Ecosystem-Based Assistance. The challenge in EBA is to balance the short-term demands for goods and services with the long-term sustainability of the ecosystem. An EBA plan is ecologically sustainable, economically sound, and acceptable within stakeholders' social and cultural values. When problems arise in an ecosystem, they are usually expressed as human values. In achieving a desired ecosystem condition, human values determine the scope and extent of problems and the associated corrective actions to be taken.

Ecosystems must be sustained for the long-term well-being of humans and other forms of life. Human land use and management decisions determine the quality, health and sustainability of ecosystems. Knowledgeable, well-informed decision-makers are essential for a sustainable agriculture and natural resource use.

The combined impacts of individual human actions and activities affect the sustainability of ecosystems and natural resource use. EBA requires the consideration of the accumulative effects of human influences within and beyond any given planning area.

EBA is based on a shared vision that is developed with all stakeholders. Keeping in mind the vision to be achieved, management objectives are developed using historical data and current ecosystem information. The goals, values and concerns of both the individual and the society determine the nature of resource management plans developed and implemented through the medium of EBA.

The viability of EBA is dependent on the voluntary participation of landowners and land users, and on their objectives regarding natural resource stewardship. These objectives should reflect the shared vision of the stakeholders. Land use and management alternatives should include economic considerations of the land user which should be in balance with the shared vision of the stakeholders.

VI. Knowledge of Ecosystems is Incomplete

The relationships between living organisms and their environment are part of an ecosystem's complexity and are not fully understood. While our knowledge of the natural world grows daily, some important relationships regarding the effects of management activities on resources and ecosystem functions are unknown. Although our knowledge is incomplete, we still provide assistance based upon the best available knowledge derived from cooperative efforts, data collection, analysis and dissemination among various agencies and groups.

To understand ecosystem complexity, scientific data and technical tools are used to help evaluate impacts upon ecosystem components and processes. In many instances individual effects on the ecosystem cannot be directly determined, therefore ecosystem health indicators are used to describe effects. Predicting both on-site and off-site effects upon ecosystem components is essential and is an inherent part of EBA.

Since many decisions are made with inherent risk and uncertainty, the concept of adaptive management is included in EBA. Adaptive management is the process of using monitoring, evaluation and experimentation to provide information to adjust future management decisions. EBA can be implemented successfully using current knowledge and technology, while recognizing that the art and science of natural resource management will continue to evolve and will never be complete or finished.

Conclusions

The EBA principles will help guide NRCS in providing enhanced assistance to private landowners. As such, two RCA-related questions need to be addressed: how will EBA affect the status and conditions of the nation's resources, and how might EBA affect the RCA analysis?

Assuming the agency fully adopts the EBA approach, the effect of EBA on natural resources could be significant. Since adopting an EBA approach to conservation planning requires a change in the mind set of conservation planners, new technology to measure changes, and new skills and knowledge, it may take as long as 10 years before EBA is fully implemented in NRCS activities. When it is successfully implemented, one would expect the following:

- Greater local involvement
- Greater use of areawide planning for goal setting
- Improved dialog among stakeholders
- A shift toward sustainable agricultural production with reduced inputs
- An increase in production of environmental goods

The effect of EBA on RCA will be to encourage more interdisciplinary work. It will require greater reliance on ecosystem health indicators to judge the status and trends of resource use.



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